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IFW 2644

UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: J. Richard Aylward, et al. **August 25, 2006**
Serial No.: 09/886,868 **Art Unit:** 2644
Filed: June 21, 2001 **Examiner:** Brian T. Pendleton
For: AUDIO SIGNAL PROCESSING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**REQUEST TO MAKE OF RECORD CERTAIN PRIOR ART
CONCERNING THE ABOVE PATENT APPLICATION**

Sir:

My client, Steven J. Eberbach, a long-standing inventor of loudspeaker technology and a former co-owner of DCM Corporation, manufacturer of the "TIME WINDOW" loudspeakers and others, continues to study the field and invent. As a part of his activities, he researches U.S. and foreign published patent documents and recently discovered a European patent application by J. Richard Aylward, et al. no. 02100699.4 corresponding to the above United States application. Both applications were filed long after the issue date of U.S. Pat. No. 5,809,150, September 15, 1998, and a review of the DCM SurroundScape Loudspeaker by Andrew Marshall originally published shortly before the issuance of this Eberbach patent. Copies of both are attached.

To summarize, the above Aylward, et al. applications appear to disclose and claim material originally disclosed in the Eberbach patent and the review. At the very least, the Eberbach patent should have been cited by Aylward if not independently found by the

examiner because DCM Corporation and Bose Corporation (Aylward's assignee) were direct competitors in 1998 and had been for several years (through Circuit City stores, in particular). Thus, Mr. Eberbach and I decided to bring the Eberbach patent and the review to the attention of the Patent and Trademark Office and make this document a part of the Aylward patent application file.

Rather than file a Protest or Public Use Proceeding, we leave to the discretion of the Patent and Trademark Office whether to reopen prosecution of the Aylward application, if the Aylward patent on this application has not issued yet.

In particular, the first point my client and I wish to make is that the Aylward written description does not appear to adequately teach how to practice the invention under 35 U.S.C. § 112. We believe that the specification, even in view of earlier cardioid directional transducers having the null and maximum lobes 180° apart and symmetrical, does not teach how to create the patterns shown in FIGs. 10a, 10b and 10c of the drawings.

The second point is that the Aylward claims to properly define the invention must be viewed in the context of the drawing figures and description of the particular directional patterns transduced. The directional aspects of loudspeaker arrays are well known to be relevant to the spacial qualities of the sound the listener perceives. If the specification is to adequately teach how to practice the invention and support the claims, then the invention must include, in the computer program for the signal processing or otherwise, the filters required to be applied in the signal paths to a directional transducer array having acoustical directivity which is "similar" to that of a human head. That is, two transducers spaced at approximately interaural distance, pointing in different directions, driven by one signal portion having substantially flat frequency response, and the other signal portion, derived

from a single first signal, having low-pass with delay characteristics similar to that of a human head, due to the interaural spacing and acoustical shadowing cabinet body similar in size.

In an earlier patent (U.S. Pat. 4,691,362), Mr. Eberbach discloses a pair of co-axial drivers spaced on a dihedral baffle "approximately the interaural distance apart" (see Abstract). This patent is incorporated by reference in the Eberbach '150 patent. Each co-axial driver has directivity in a different direction, in a manner similar to the two ears mounted upon a human head, with directivity increasing with frequency and a delay versus angle of incidence defined by the interaural distance plus the effect of an intervening body. In claim 23, the description may be simply limited to "each component sound radiating system having directivity defined by at least one major lobe ... with an axis, the two axes being directed non-parallel" (Col. 15, lines 33-36).

When this bi-directional transducer array is further driven by one or two input signals processed according to Eberbach '150, the filtered signals having relative delay and amplitude characteristics to those characteristics of a human head and ears for various angles of arrival or departure of the sound, the result is one or two skewed cardioid, subcardioid or hypercardioid directional patterns directionally transduced from the speaker array.

This dual co-axial driver transducer array with filters and interaural spacing of transducers was marketed by DCM Corporation before the independent review by Andrew Marshall in Audio Ideas, noted above, and issuance of the '150 patent. Andrew Marshall is at least ordinarily acquainted with the state of the art, and he verified the maximum and minimum both substantially flat response directions of the radiating pattern in his review.

The third point is the filters described in FIG. 9 and the specification of this Aylward application, which impliedly produce skewed asymmetric patterns having a forward-facing maximum lobe less than 120° from the forward-facing null, or minimum as earlier disclosed and claimed in the Eberbach '150 patent. Clearly, this Eberbach patent is pertinent prior art to this Aylward application.

The fourth point pertains to FIGs. 1a and 1b of this Aylward application. With or without the rear speakers (which are suggested in the Andrew Marshall article, fourth paragraph from the end), comparison with the Eberbach '150 patent clearly shows the pertinence, if not obviousness or anticipation when the accompanying text and claims are compared which we leave to the examiner. The similarity in result is clear. The '150 patent discloses means to cause the sound from speakers forward of the listening position to apparently and selectively come from forward or rearward, simply depending on the signal channels sent to the speakers from normal surround sound recordings as does this Aylward application.

The fifth point pertains to the sale of the VLS (Visual Listening System) by DCM Corporation in 1998 and 1999 which combined technology licensed from Dolby Laboratories Licensing Corporation with technology described in a continuation-in-part application by Eberbach (based on the Eberbach '150 patent). The Dolby technology eventually issued as U.S. Pat. 6,449,368 (Davis et al.) and the Eberbach technology recently issued as U.S. Pat. 7,092,541. The signal processing described in the Dolby patent was combined with the directional transducing of the Eberbach patent.

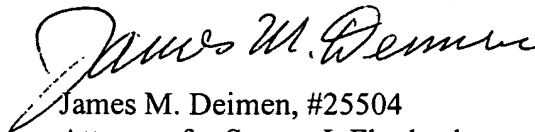
The Dolby simplified cross-talk cancellation is used with the directional transducing to further assist the channel separation at the listener's ears and magnify the effect of the

Dolby signal processor. The Dolby signal processor also includes spectrum portion dividing (delay and frequency response), (similar to that of the human head) amplitude scaling, and parametrically variable-gain overload reduction means (column 5, line 63 et seq. Dolby patent).

Dolby (column 3, line 38 et seq.) specifically describes the "selection" of apparent sound source position as "forward or rearward" (or moving both forward and rearward, which is spacial articulation) by creating a perceived virtual sound image dynamically displaced from the physical speaker(s) in two dimensions of space surrounding the listener, who is facing "forward."

The use of this combination of Dolby and Eberbach technology in the VLS loudspeakers sold by DCM Corporation in 1998-1999 appears to be very pertinent prior art to this Aylward patent application. Mr. Eberbach is available to speak directly with the examiner by telephone or answer questions by email if so desired by the examiner.

Respectfully submitted,



James M. Deimen, #25504
Attorney for Steven J. Eberbach
320 N. Main Street, Suite 300
Ann Arbor, MI 48104-1192
Phone: (734) 994-5947
Fax: (734) 769-2702



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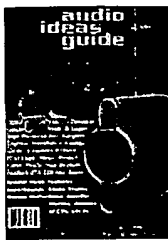
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REQUEST TO MAKE OF RECORD CERTAIN PRIOR ART CONCERNING THE ABOVE
PATENT APPLICATION

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James M. Deimen, #25504

Attorney for Applicant
320 N. Main Street, Suite 300
Ann Arbor, MI 48104-1192



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DCM SurroundScape Loudspeaker

Sugg. Retail: \$2198 pr (U.S.)**Size: 46"H x 16 1/4"W x 12 1/2"D****DCM SurroundScape Centre Channel****Sugg. Retail: \$279 (U.S.)****Size: 7 1/2"H x 23"W x 8"D****Manufacturer: DCM Loudspeakers**

**670 Airport Boulevard, Ann Arbor, Michigan 48108 U.S.A.
(313) 994-8481 FAX (313) 994-0190**

DCM was a fairly well known speaker line in Canada a few years ago, but since Bryston ceased distribution of it, the brand has pretty much gone away. In the U.S., however, the company has remained active with a strong dealer base that starts with Circuit City. I've known DCM designer Steve Eberbach as a talented and creative engineer, and have owned two of his TimeFrame transmission-line models over the years.

It was just two years ago that I encountered his first approach to the SurroundScape home theatre speakers, which attempt to provide full surround sound with only front speakers. It's basically a Time Window with a twist of phase, so to speak, for the surround signal, which is fed to the outer array of drivers on each side.

But maybe I'm getting a little ahead of myself. The original Time Window design used a forward-pointed enclosure with a pair of baffles containing identical driver complements opposed at about 80 degrees. This allowed wide dispersion and very even radiation at all frequencies into the room. Bass loading of the woofers is via a transmission line that ports at rear.

Steve's big idea was to take this design and, as noted, utilize the outer driver set (a 6 1/2" woofer and dome tweeter in a coaxial array) to carry the surround information, bouncing it off side walls; some electronic phase manipulation was provided in the crossover to make the sound seem to come from behind. Now, this type of processing is no longer uncommon, starting even before Q-Sound and now found in the Spatializer and Virtual Dolby techniques being now being included in multimedia computer systems.

So in the SurroundScape system we have the inner drivers facing in towards the listener on a quite narrow baffle not unlike Ken Kantor's approach with NHT, while the outer ones face outward to use wall reflections to reinforce the surround effect. There are also rear-mounted tweeters for front and rear sound to add spaciousness, and the front woofer system is augmented a powered internal subwoofer, with adjustment of level and upper crossover on the rear panel. As you can see, this is a pretty sophisticated piece of design work.

DCM call their crossover design PrestiDigital, allowing "precise time equalization" in the phase shifting that creates the surround effect. The literature sheet goes on: "Our new Shadow Driver Management™ System produces a spectrally-shaped, phase matrixed, ambient field that completes a seamless surround soundstage of front and rear speakers."

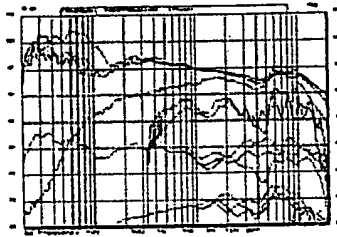
The accompanying centre channel looks pretty ordinary, shaped to fit on top of or under a monitor. But removing the grille cover reveals not a D'Appolito array, but a coaxial driver array identical to those in the SurroundScapes, with tweeter mounted on a perforated metal screen that covers the woofer/midrange driver. The tweeters in both speakers are all identical small domes with phase plugs suspended across their centres, this determined largely by feel in the case of the left and right speakers, the black cloth grilles not removable.

The measurements of this system were somewhat more complex than usual, and took the better part of a working day to accomplish. The first chart shows, from top to bottom, the Pink



non-powered version is prior art to "bass augmenting" in Aylward!
more prior art!
reference to Kantor's directrinal technique

Noise Sweep, with the bass controls set for flattest response (this is the squiggliest one in the bass) with smoothed similar measurements showing the highest and lowest bass crossover settings.

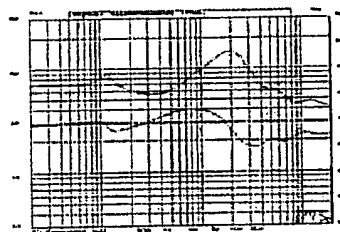


The fourth curve in this group, the one that slopes off below 1000 Hz is the PNS of the rear driver array, which clearly has its bass rolled off, obviously to prevent cancellations of the front drivers' low end response because of the electrical phase inversion employed for the surround effect. The surround channels are also a db or two lower in level in the midrange.

Below are quasi-anechoic curves for both driver arrays taken on axis, which here means not on the axis of the baffle board, but at the listening axis. This means that each baffle was angled about 40 degrees away from the listener, the inside ones facing in, and the outside ones at the side walls with the speaker cabinet facing straight ahead.

Thus, the central listening position is best represented in the axial curves by the 15 and 30 degree curves, which are very smooth, the latter having a midrange dip. It goes without saying that there are a lot of acoustic things happening in this system, especially with surround encoded material, and Eberbach has achieved excellent overall linearity for such a complex design. At bottom, the rear channel's responses can be seen to match timbrally quite well.

Impedance curves were also quite similar, peaking at 13 or 14 ohms in the midrange, and being lowest at higher frequencies. With a powered subwoofer, low-frequency impedance is a simple resistance of 7 ohms for the front, with a mild peak of the same value just below 100 Hz in the rear channels. Phase shift through crossover is well controlled in both, with a double



shift seen in the rear, the trace rising with increasing frequency above 4 kHz. I'm not sure of the significance of this, but it does suggest some electrical phase shifting in the midrange to enhance the surround effect.

The centre channel speaker matches well timbrally as far as the measurements are concerned, with the same moderate forwardness giving way to flatter response as we move around to 30 degrees; those to the left and right of the centre seat will find dialogue emphasized a little

more than with most D'Appolito-configured designs, perhaps a good thing if you're close to the left or right speaker.

Most such designs, with midrange/woofers flanking the tweeter show a significant suckout in this middle frequency range off axis.

Impedance of the centre channel is a little higher, peaking at 27 ohms in the bass, and 20 at crossover; electrical phase is quite similar to the left, right, and surround speakers.

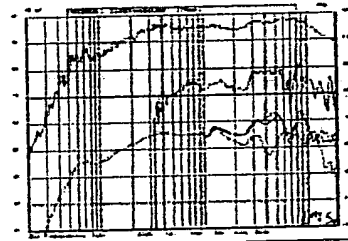
I've heard these speakers at CES shows do some quite amazing things, their ability akin to a true ventriloquist in throwing images behind the listener (though that part of ventriloquism is not actually possible). The effect is totally dependent on side walls, and when I first hooked them up in my home theatre room I was not surprised that the same thing that helps other surround systems to be effective, namely my ACCO panels absorbing first reflections, virtually destroyed the illusion of SurroundScape. Removing the panels, and some careful speaker placement allowed me to hear what had been so impressive at shows.

These speakers like to be fairly close to side walls, and work best in a fairly narrow room; ours is a little wide at 14 feet. While trying to tune the bass, I realized why both level and crossover controls are provided; it will take time for any new owner to optimize these speakers to the room. I found a problem in mine in the mid-bass: there was hardly any, while the deepest bass was overwhelming around 30 Hz. Experimentation solved this imbalance.

Another thing to look out for is too much delay in the rear channels; since this is done acoustically by the wall reflections, delay in the receiver or surround processor should be set to its minimum value to avoid a quite pronounced flutter echo that muddies images. This was worst with DSP modes that use a lot of digital delay. Avoid these with SurroundScape.

Having set things up, I started watching movie clips and listening to both discrete and matrix

*measurement
of 150
reduced to
practice
by independent
reviewer/
analyst.*



surround program material. In the former case, the 'Cows' segment of Twister from the Pioneer DVD sampler was very effective in Dolby Digital ("I gotta go, Julie, we got cows..."), the swirling tornado all over the room.

With music, especially classical, the soundstage was huge, extending well outside the speakers, and occasionally wrapped right around the listener. With such LDs as Hell Freezes Over the audience seemed between the listener and the Eagles, but applause tended to come from outside the speakers, not from behind.

In other words, the surround effects are not always as predictable as with real speakers behind, but if you forget about all this you can become immersed in the home theatre experience, forgetting speakers altogether. DCM do suggest that in some circumstances rear speakers should be added (check out their excellent web site: (www.dcmspeakers.com)), especially in larger rooms, but in many you can get along fine without them.

And in smallish rooms, you can also avoid worrying about a subwoofer, the Surroundscape system capable of powerful bass down to about 25 Hz; I don't know how Eberbach has done this with relatively small woofers, but his transmission line definitely transmits. This was also true of my TimeFrame 1000s.

For stereo music listening, this may not be the system for the purist, with all that PrestiDigital crossing over and Shadow Driver Management™ (though the latter characteristic might make it the speaker for Lamont Cranston: "The Shadow knows...ha, ha, ha, ha"), but it can present a very convincing soundstage with acoustic music, especially when using a simple matrix like DynaQuad or other ambient recovery techniques that avoid digital delay or other artificial processing. In this configuration the system can become quite revealing, with oodles of spatial information that somehow gets lost in many high end minimonitors. I think these speakers are excellent reproducers of music, with good transient speed, broad, quite smooth frequency response, and very convincing imaging. Being a fan of surround music listening, I guess I'm predisposed to like the latter effect.

Whether you do or not, the DCM Time Window Surroundscape is a fascinating and challenging speaker system that should be auditioned if you're intrigued by the concept. This is a completely realized design that is unique, and provides a compelling listening experience for both music and home theatre.

Andrew Marshall



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